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A NEW PUTATIVE HYBRID IN *SILPHIUM* (ASTERACEAE: HELIANTHEAE)

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ABSTRACT

The occurrence of a novel putative hybrid from Jackson County, Missouri, is reported and discussed. This hybrid occurs spontaneously at an upland prairie restoration site and appears to represent the cross *Silphium integrifolium* × *S. laciniatum*. The morphological features of the presumed parents and putative hybrid are discussed and contrasted. The literature on hybridization in Midwestern *Silphium* is reviewed.

KEYWORDS: *Silphium*, Asteraceae, hybridization, Missouri flora

The genus *Silphium* L. comprises a dozen species of herbaceous perennial in the large angiosperm family Asteraceae (Clevinger 2006). It is endemic to the North American continent with all of the species occurring in the United States east of the Rocky Mountains and only a few ranging farther south or west. Most of the species are distinctive morphologically and, although the widespread taxa exhibit considerable variation and have sometimes been divided into varieties or subspecies, in general the species are relatively easily distinguished.

In Missouri, Yatskievych (2006) treated six species, which include such well-known wildflowers as compass plant (*Silphium laciniatum* L.), cup plant (*S. perfoliatum* L.), prairie dock (*S. terebinthinaceum* Jacq.), rosinweed (*S. integrifolium* Michx.), and starry rosinweed (*S. asteriscus* L.), and also the uncommon and likely non-native rough-leaved rosinweed (*S. radula* Nutt.). Reports of interspecific hybrids between these taxa have been few. Steyermark (1963) mentioned possible hybridization between *S. asteriscus* L. and *S. integrifolium*, based on rare plants keying to the latter species but with some of the leaves alternate. However, possible past introgression between these species has not been documented in the subsequent botanical literature, and the aberrant plants may represent merely morphological variation within *S. integrifolium*.

Yatskievych (2006) mentioned specimens collected in Bates and Warren counties that appear to represent the hybrid, *Silphium integrifolium* × *S. perfoliatum*. These plants have only the uppermost leaves somewhat perfoliate and the involucral bracts are intermediate in morphology between the putative parents. They are not morphologically equivalent to plants described earlier from Stone County as *S. perfoliatum* f. *petiolatum* E.J. Palmer & Steyerm. (1958). Cruden (1960) suggested that f. *petiolatum* represented late-season specimens with somewhat dwarfed morphology and did not think it necessary to formally recognize this morph taxonomically.

Steyermark (1963) mentioned the existence of hybrids between *Silphium laciniatum* and *S. terebinthinaceum* in other states, but had not seen any material collected in Missouri. Subsequently, Redfearn (1980) reported such hybrids from mixed populations of the parental taxa in Dallas and Stone Counties (as well as from northern Arkansas). This appears to be the most common, naturally occurring interspecific hybrid in the genus. It was studied by quantitative analysis of morphological

features by Fisher (1959, 1966), based on populations in Illinois, Indiana, and Ohio.

Later, Fisher and Speer (1978) presented cytological and morphological evidence that this hybrid is of more widespread occurrence in the southeastern United States and, in fact, had long ago received its own binomial, *Silphium pinnatifidum* Elliott. However, it should be noted that because her molecular studies (Clevinger 2000) had indicated a very close affinity between *S. pinnatifidum* and *S. terebinthinaceum,* Clevinger (2006) chose to treat this taxon as *S. terebinthinaceum* var. *pinnatifidum* (Elliott) A. Gray rather than as an interspecific hybrid. Thus, the relationship of plants described as *S. pinnatifidum* to those documented as hybrids between *S. laciniatum* and *S. terebinthinaceum* requires further study.

A new hybrid *Silphium*.

During recent botanical field work in Jackson County, the senior author discovered a single individual that appears to represent yet another putative hybrid *Silphium* in Missouri. The presumed parents of this hybrid are *S. integrifolium* var. *integrifolium* and *S. laciniatum*, which were the only two species in the genus occurring in the vicinity of the morphologically aberrant individual.

The site at which this find was made is Jerry Smith Park (formerly Jerry Smith Farm Park), a nature park on the south side of the Kansas City metropolitan area (38° 52' 57" N Lat., 94° 34' 04" W Long.), in Jackson county. It is owned by the Kansas City Parks and Recreation Department and managed with help from the Missouri Department of Conservation (which owns the small, adjacent Saeger Woods Conservation Area), Kansas City WildLands (a private group promoting biodiversity and plant community restoration in the metropolitan region), and other organizations. This 360-acre site came into public ownership in 1976. Management efforts since then have focused on restoration and expansion of the initially small persistent patches of natural upland tallgrass prairie. Today, more than a third of the property has prairie habitat in varying degrees of restoration.

Within Jerry Smith Park, a loop trail creates access to much of the property. At one point where this trail crosses the prairie, a spur leads westward to an observation platform. Near this station, a large population of *Silphium laciniatum* occurs. The only other *Silphium* species in the vicinity is a population of *S. integrifolium* located some 70 m away. The presumed hybrid was found in the patch of *S. laciniatum* and presented a sharp contrast morphologically to this taxon. Voucher specimens of *S. integrifolium, S. laciniatum*, and the putative hybrid (*Jessee s.n.* on 3 October 2011) were deposited at the Missouri Botanical Garden herbarium (MO).

Selected morphological features contrasting the parents and their presumed hybrid at this site are summarized in Table 1. Observations of the parents made for this study do not represent rangewide measurements but rather are from plants at Jerry Smith Park. More detailed descriptions of the parental taxa in Missouri are in Yatskievych (2006) and rangewide in Clevinger (2009).

The putative hybrid generally appears irregularly intermediate between the parents (Fig. 1). It does not have basal leaves present at maturity, but the leaves tend to be strongly and progressively larger from the distal portion of the stem to its proximal portion. The uppermost cauline leaves are opposite and sparsely serrate to shallowly few-lobed, with progressively more proximal leaves showing an increase in the number and depth of the lobes. Bipinnatifid leaves are not produced.

Stem pubescence tends to be similar to that of *Silphium integrifolium* in the dense, short hairs, but scattered, longer, more strongly bulbous-based hairs are present distally in the hybrid (Fig. 2). Leaf pubescence is less easily diagnosed, but in particular, the trichomes on the proximal portion of the abaxially raised midvein are longer in *S. laciniatum* than in *S. integrifolium*, with the hybrid variable but somewhat intermediate.

Table 1. Selected morphological characteristics of *Silphium integrifolium, S. laciniatum*, and their putative hybrid. Note that observations are based on plants at the particular property under study and are not intended to represent rangewide measurements.

Character	*S. integrifolium* var. *integrifolium*	*S. laciniatum*	Putative hybrid
Upper cauline leaves (below inflorescence)	opposite, margins entire	alternate, margins toothed or lobed	opposite, margins toothed or lobed
Lower cauline leaves	entire	lobed to pinnatifid	irregularly lobed
Basal leaves	absent at flowering	large, present at flowering	absent at flowering
Distal stem pubescence	dense, short (0.1–0.5 mm)	moderate to dense, long 1–4 mm)	dense short + scattered long
Inflorescences	flat-topped to hemispheric-paniculiform, rarely unicapitulate	elongate, racemiform sometimes with few, ascending branches	hemispheric to ± elongate, ± paniculiform
Involucral bracts	elliptic to broadly ovate; tips angled to short-attenuate, the longest 12–15 mm	ovate to narrowly ovate, tips long-attenuate, the longest 14–22 mm	ovate to narrowly ovate, tips short- to long- attenuate, the longest 28–40 mm

In quantitative features of the head (overall size, phyllary length, number of rays, etc.) the hybrid is also more or less intermediate. Involucral bracts are ± intermediate in both shape and maximum size (Fig. 3). Receptacular bracts are too variable in shape depending on position in the head to be of use in distinguishing the parents. However, one qualitative feature of these bracts that is difficult to quantify or illustrate with photographs is their pubescence. In *Silphium integrifolium*, the chaffy bracts are pubescent dorsally with short, stiff, ascending hairs in the distal half. The apical margin is ciliate with short hairs that are not much longer than the surface trichomes. In contrast, receptacular bracts of *S. laciniatum* are pubescent dorsally in only the distal portion with trichomes that are somewhat longer than those in *S. integrifolium*. The margins are ciliate with a fringe of hairs that are longer than those of the surface. The bracts thus appear minutely comose or bearded apically (under magnification).

Achenes of the hybrids generally appear flat and inviable (Fig. 4). They lack the embedded glands characteristic of the putative parents and generally appear pale at maturity. In other respects, the achenes of the parents are too similar to offer morphological contrasts.

Discussion.

In the 1960s, several students working under T. Richard Fisher at Ohio State University completed Master's and Doctoral studies involving the biosystematics of selected species in *Silphium*. Sadly, much of this research was never published. One of the students, Wilbur Settle (1967) studied the chromosomal morphology of *Silphium* species, all of which have a chromosome number of $2n = 14$. Soon thereafter, Dennis Anderson (1968) demonstrated that three karyotypic groups could be distinguished, based on reciprocal translocations involving the two longest chromosomes. Settle and

Fisher (1972) conducted a program of artificial hybridizations between *S. integrifolium* and other members of the genus. At least some of their controlled crosses involving *S. integrifolium, S. asteriscus*, and S. *perfoliatum* produced hybrids with normal chromosomal pairing at meiosis that potentially were fertile. In contrast, crosses involving *S. integrifolium* and other species, such as *S. laciniatum*, resulted in hybrids with abnormal pairing at meiosis (5 bivalents and 2 quadrivalents) and thus were mostly sterile. The observation that the achenes in our putative hybrid of *S. integrifolium* × *S. laciniatum* appear flat and inviable (Fig. 3) agrees with these results.

To our knowledge, this is the first documented report from anywhere of a naturally occurring hybrid between *Silphium integrifolium* and *S. laciniatum*. It should be noted that Gardner (2011) mentioned having observed an individual of this hybrid (presumably somewhere in Illinois) that grew from seed collected from a *S. laciniatum* parent. However, he did not provide any further details and apparently did not gather a voucher specimen. It will be interesting to see whether this unusual hybrid persists in Missouri. Future studies should be conducted to confirm the parentage and hybrid status using cytological or molecular techniques.

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LITERATURE CITED

Anderson, D.M. 1968. Monograph of the genus *Silphium*: *S. laciniatum* L. and *S. albiflorum* Gray. M.S. thesis, Ohio State Univ., Columbus.

Clevinger, J. 2000. Phylogenetic analysis of *Silphium* and subtribe *Engelmanniinae* (Asteraceae: Heliantheae) based on ITS and ETS sequence data. Amer. J. Bot. 87: 565–572.

Clevinger, J. 2006. *Silphium* Linnaeus. Pp. 77–82 *in* Flora of North America Editorial Committee, eds. Flora of North America, North of Mexico. Volume 21. Magnoliophyta: Asteridae, Part 8: Asteraceae, Part 3. Oxford Univ. Press, New York.

Cruden, R.W. 1960. Biosystematic studies in the genus *Silphium*: the perfoliate taxa. M.S. thesis, Ohio State Univ., Columbus.

Fisher, T.R. 1959. Natural hybridization between *Silphium laciniatum* and *Silphium terebinthinaceum*. Brittonia 11: 250–254.

Fisher, T.R. 1966. The genus *Silphium* in Ohio. Ohio J. Sci. 66: 259–263.

Fisher, T.R. and J.M. Speer. 1978. Systematic studies in the genus *Silphium*: possible origin of *S. pinnatifidum* Ell. (Compositae). Pp. 451–463 *in* D.N. Sen (ed.), Environmental Physiology and Ecology of Plants. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.

Gardner, H.W. 2011. Tallgrass Prairie Restoration in the Midwestern and Eastern United States. Springer Science+Business Media, New York.

Palmer, E.J. and J.A. Steyermark. 1958. Plants new to Missouri. Brittonia 10: 109–120.

Redfearn, P.L., Jr. 1980. *Silphium* hybrids. Missouriensis 2(2): 15.

Steyermark, J.A. 1963. Flora of Missouri. Iowa State Univ. Press, Ames.

Yatskievych, G . 2006. Steyermark's Flora of Missouri, revised ed., vol. 2. Missouri Botanical Garden Press, St. Louis.

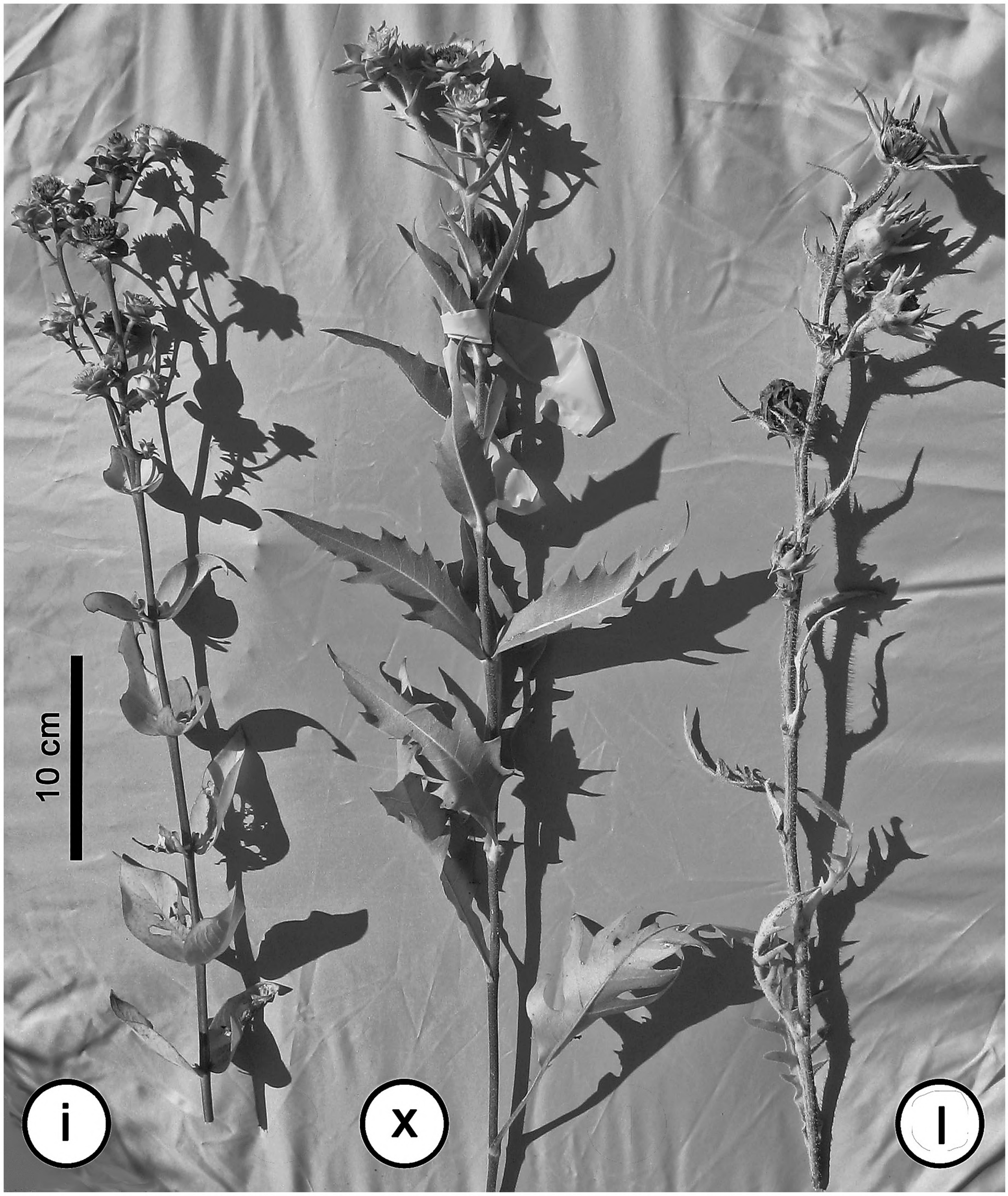

Figure 1. Representative stems with foliage and inflorescences of *Silphium integrifolium* (i), *Silphium laciniatum* (l), and their putative hybrid (x).

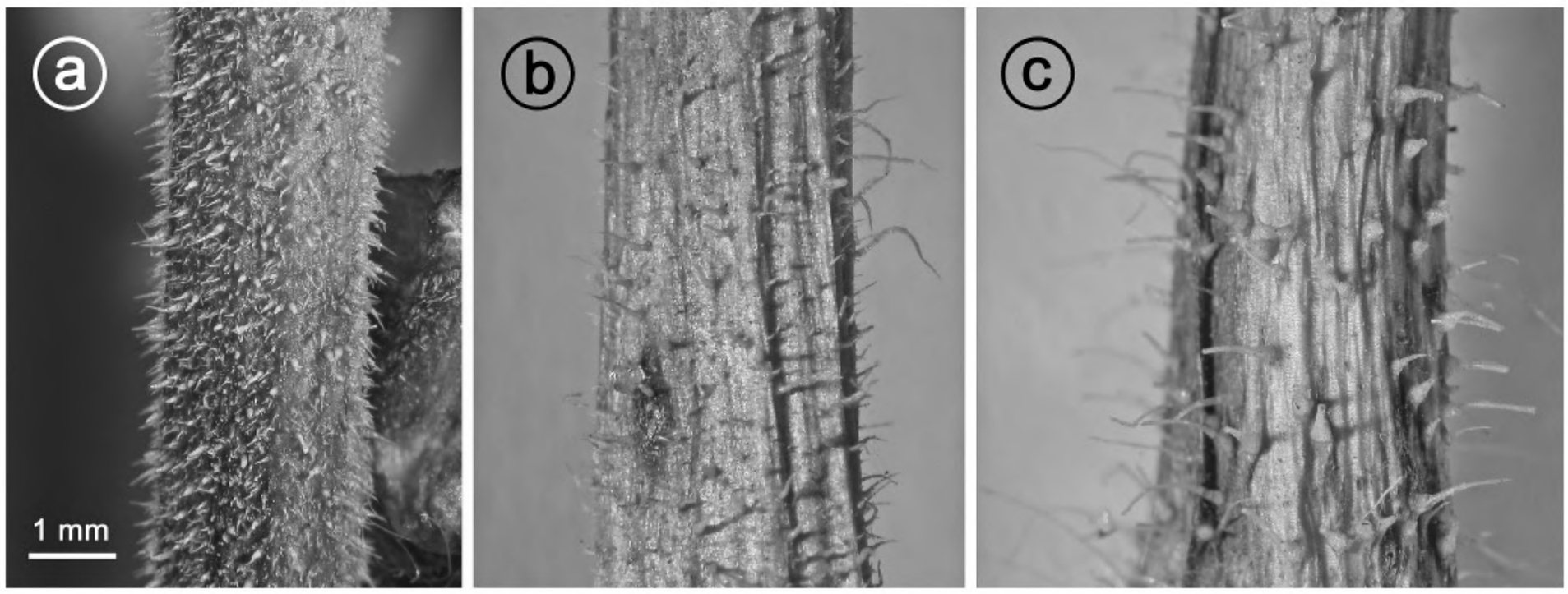

Figure 2. Pubescence of stems at the first internode below the inflorescenc. a = *Silphium integrifolium*; b = putative hybrid; c = *Silphium laciniatum*.

Figure 3. Representative inflorescences and heads of *Silphium laciniatum* (a), the putative interspecific hybrid (b), and *Silphium integrifolium* (c)

Figure 4. Representative receptacular bracts and achenes of *Silphium integrifolium* (i), *Silphium laciniatum* (l), and their putative hybrid (x). Row labels: b = bracts; d = achenes, dorsal view; v = achenes, ventral view.